Conference Volume | 6th Symposium for Research in Protected Areas | 2 to 3 November 2017, Salzburg | pages 769 - 772

ArcGIS-generated map of FFH-habitat types for Natura-2000 site Ennstaler Alpen/Gesäuse (Styria, Austria)

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Abstract

Presented is a map of FFH-habitat types of Natura 2000-area 'Ennstaler Alpen/Gesäuse' set up by National Park Gesäuse. It combines terrestrial mappings and ArcGIS-modelled areas based on aerial photo analysis and forest stand types. The 26 evidenced FFH-habitat types cover 75% of the Natura 2000-area. Due to the alpine character, limestone rocks (8210, 8240), calcareous screes (8120, 8160), mountain pine bushes (4070), calcareous grasslands (6170) and natural spruce forests (9410), which surpass the deciduous forests (91E0, 9130, 9140, 9150, 9180) altogether, are the predominant habitat types.

Keywords

National Park Gesäuse, Natura 2000 site Ennstaler Alpen/Gesäuse, FFH habitat types, GIS modelling, HABITALP aerial photo interpretation, field mapping, forest stand types

Introduction

From the beginning, the first accurate map of FFH-habitat types of the Natura-2000 site Ennstaler Alpen/Gesäuse (HÖBINGER 2012) posed an interim result only, due to missing 'real' data blending and partly insufficient terrestrial data (especially concerning beech forests, Tilio-Acerion forests and bogs). More recent terrestrial mappings plus a validation of the implemented aerial photo interpretation (HAUENSTEIN & HALLER 2013) initiated a revision.

Figure 1:© T. Zimmermann

Methods

Instead of vegetation mosaics, the new map version depicts the predominant type only. Although this is less precise in terms of surface area in comparison to using complex units, it is quite advantageous when it comes to map readability. While some small-scale, interspersed FFH-habitat types such as 6110 (Alysso-Sedion albi) are certainly underrepresented, in the case of more common types that frequently occur in combination with others, like calcareous grasslands (6170) on calcareous rocky slopes with chasmophytic vegetation (8210), we assume that assigning a type to one or the other category is somehow balanced in the end.

Habitats without FFH-status were put in meaningful units such as tall natural grasslands, nutrient-rich alpine pastures, waters, pioneer forests, scots pine forests or artificial spruce forests.

Data blending of several terrestrial mappings presupposed a careful investigation of the various mapping units and their transformation into FFH-habitat types (ZIMMERMANN 2013). To reduce conflicts that arise from differing vegetation identification, special mappings were favoured over more general mappings because of their stronger focus, which means that a data hierarchy was induced. On the other hand, very differentiated mappings had to be partly simplified in order to reach consistent FFH-habitat type definitions over the whole map (this is especially true for biotope mapping).

The majority of woods and shrubs, which represent about 60% of total land coverage, are not mapped but modelled based on local forest stands (CARLI 2008) and aerial photo interpretation (see ZIMMERMANN & KREINER 2012). Due to the very accurate elevation model, it was possible to calculate with raster cells of 2x2 metres, which is a resolution fine enough not to lose narrow linear structures such as forest roads or creeks. On the other hand, whenever relief data is incorporated into the modeling, the small cell size will cause a very patchy appearance, which does not provide a correct picture of the situation, since a forest type is only making sense if a certain minimum size is reached. It was therefore necessary to smoothen (that is: coarsen) the calculated repectively imported terrestrial mapping data via multiple filter rounds, in order to eliminate micro areas. Also, very elaborately mapped regions proved to be better integrated into the rest of the map afterwards.

Conducting a ‘real' data blending offers the possibility to analyze the FFH-habitat types with respect to their location preferences, i.e. their abundance in relation to parameters such as geological underground, altitude, exposition, slope, radiation energy and so on. Furthermore, the map is going to be the spatial foundation for the projected modeling of the corresponding conservation statuses.

Results

In the following, the resulting numbers for the Natura-2000 site are presented.

Absolute and relative shares of vegetation formations	**14.524,6 ha**	**100,0 %**
woods	6.657,7 ha	45,8 %
shrubs	2.192,1 ha	15,1 %
tall grasslands, clearings, pastures, calcareous grasslands	2.243,9 ha	15,5 %
rocks and screes	2.834,4 ha	19,5 %
waters	108,6 ha	0,7 %
non-natural areas and/or vegetation-free	487,9 ha	3,4 %

Table 1 shows the overall distribution of the occurring vegetation formations.

The 145 km² Natura-2000 site is composed of 61 % woods and shrubs, 20 % rocks and screes, 15 % tall grasslands, clearings, pastures and calcareous grasslands, 3 % non-natural resp. vegetation-free areas and 1 % waters.

Absolute and relative shares of FFH-habitat types	**14.524,6 ha**	**100,0 %**
FFH-habitat types – woods and shrubs	6.464,5 ha	44,5 %
FFH-habitat types – open land	4.560,3 ha	31,4 %
no FFH-habitat types	3.499,8 ha	24,1 %

Table 2 shows the overall amount of area occupied by FFH-habitat types.

About 76 % of the map area represent FFH-habitat types, while only 24 % do not have a FFH status (which does not mean that they aren't in part ecologically valuable, as are the thermophilic Scots pine forests or the species-rich *Calamagrostis varia*-grasslands in avalanche corridors). The FFH-types consist of 60 % wood and 40 % open land habitat types.

FFH	Description	ha	%
-	Non-natural and/or vegetation-free	487,9	3,36
-	Artificial spruce forests	1.969,9	13,56
-	Scots pine forests	344,7	2,37
-	Pioneer woods	71,1	0,49
-	Tall natural grasslands	329,0	2,26
-	Waters without FFH-status	107,2	0,74
-	Cultivated grasslands without FFH status	190,1	1,31
3220	Herbaceous vegetation along the banks of alpine rivers	1,4	0,01
3240	Ligneous vegetation with *Salix eleagnos* along alpine rivers	3,2	0,02
4060	Alpine and boreal heaths	2,2	0,01
4070	Bushes with *Pinus mugo* and *Rhododendron hirsutum*	2.188,8	15,07
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	uncertain	uncertain
6150	Siliceous alpine and boreal grasslands	2,2	0,01
6170	Alpine and subalpine calcareous grasslands	1.593,4	10,97
6230	Species-rich *Nardus*-grasslands on silicious substrates in mountain areas	1.593,4	10,97
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	84,6	0,58
6510	Extensively managed hay meadows of the planar to submontane zones (Arrhenatherion)	6,6	0,05
7110	Active raised bogs	0,2	0,001
7140	Transition mires and quaking bogs	0,2	0,001
7220	Petrifying springs with tufa formation	uncertain	uncertain
7230	Alkaline fens	1,5	0,01
8120	Calcareous screes of the montane to alpine levels	314,3	2,16
8160	Medio-European calcareous scree of hill and montane levels	303,9	2,09
8210	Calcareous rocky slopes with chasmophytic vegetation	2.206,8	15,19
8240	Limestone pavements	9,4	0,06
8310	Caves not open to the public	uncertain	uncertain
91E0	Alluvial forests (Alnion incanae, Salicion albae)	34,0	0,23
9130	Asperulo-Fagetum beech forests	882,6	6,08
9140	Medio-European subalpine beechwoods with *Acer* and *Rumex arifolius*	366,5	2,52
9150	Medio-European limestone beechforests of the Cephalanthero-Fagion	414,8	2,86
9180	Tilio-Acerion forests of slopes, screes and ravines	43,8	0,30
9410	Acidophilous Picea forests of the montane to alpine levels	2.077,0	14,30
9420	Alpine Larix decidua and/or Pinus cembra forests	453,3	3,12
	Total area in ha	**14.524,6**	**100**

Table 3 shows the shares of all depicted vegetation types in particular.

The overall distribution of the types reflects the alpine character of the Gesäuse area: Screes and rocks with sparse vegetation (8120, 8160, 8210, 8240) represent 1/5 of the total area, and *Pinus mugo*-shrubs and calcareous grasslands (4070, 6170) together account for 1/4. Another 1/5 is made up of natural coniferous forests (9410, 9420); their main area of distribution lies in the subalpine zone, but due to the rugged relief and vegetation dynamics along debris flows they can descend to the lower montane zone (in that case they often form Scots pine forests without FFH status).

In comparison, only a small area of 1/8 is composed of deciduous forests (9130, 9140, 9150, 9180, 91E0, pioneer forests); taking into account that a further 1/8 of the area are potential deciduous forest stands currently occupied by artificial spruce forests with no FFH status, the share of deciduous forests would rise to 1/4 in a near-natural situation, though.

So far, 26 FFH-habitat types have been recorded in the area. One is underground (8310) and cannot be incorporated in the area summary (according to HERRMANN 2016, 463 caves have been recorded so far). Another two (6110, 7220) only occur in sizes of a few square meters, which is why the map just indicates their existence (point-signature) instead of their actual size; but it is safe to assume that both belong to the rarest types in share of area.

The most common habitat types by far are represented by 8210, 4070, 9410 and 6170, which contribute 11-15% of the map area each. So these four together already account for 73 % of the overall FFH area.

The next most common FFH-habitat type is 9130, which contributes about 6 %. Followed by a number of FFH-habitat types, which share 2-3 % each: 9420, 9150, 9140, 8120 and 8160. Summarizing the 10 FFH-types mentioned so far, over 98% of the total FFH area are reached.

That means that the remaining 15 types account for only 2% of the total FFH-area. In decreasing order these rare types are: 6430, 9180, 6230, 91E0, 8240, 6510, 3240, 4060, 6150, 7230, 3220, 7110 and 7140, plus 6110 and 7220, which were not calculated.

The reasons for the relative scarcity of those FFH-habitat types are manifold: Mainly, it's regional specifics such as the scarcity of truly acidic soils (6230, 4060, 6150, 7140), the general lack of water on limestone (6430, 7230, 7110, 7140), unfavourable relief and altitude (7110, 7140), a lack of gravel bars suitable for vegetation (3240, 3220) as well as the absence of rural settlements (6510). In part, forest conversion of former stands is responsible (9180, 91E0). Finally, some habitat types are small-sized by nature (6110, 7220).

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